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ABSTRACT

Previous research has found a high level of interdependence among national stock markets. This study investigates whether traders in the new Nikkei futures contracts can profit from these interactions by following the performance in the U.S. equity market. As expected, the U.S. return has a great impact on the overnight futures return. However, some evidence of overreaction exists as the open to close futures return tends to be inversely related to the U.S. return, particularly after a large increase in U.S. equity markets.

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DO THE NIKKEI STOCK INDEX FUTURES FOLLOWS THE S&P 500? A WEAK FORM EFFICIENCY TEST

Research on international equity market linkages has discovered a high degree of interdependence among national stock markets. Jaffe and Westerfield (1985a), Schollhammer and Sand (1985), and Eun and Shim (1989) employed daily market closing data for several countries and found that linkages between stock markets were substantial.

Recent papers [Bennett and Kelleher (1988), Dwyer and Hafer (1988), Goodhart (1988), King and Wadhwani (1988), Neumark, Tinsley, and Tosini (1988), and Roll (1988)] investigated international equity market linkages around the October 1987 crash. The papers generally discovered strong cross-exchange linkages after the crash.

Becker, Finnerty, and Gupta (1989) found that, for a recent time period, the U.S. equity market greatly influenced Japanese equity returns. For example, correlations between lagged S&P 500 open to close returns and open to close Nikkei Index[1] returns were between .26 and .49.[2] In addition, large movements in the U.S. predicted market changes in Japan remarkably well. Trading rules were set up in which a trader in Japan buys or sells at the open price, depending on the performance in the U.S. market, and closes the position at the end of the day. When up filters were triggered, the Nikkei Index increased the next day 72% to 81% of the time.[3] The down triggers selected market decreases the next day with slightly less precision, 59% to 75%.[4]

High correlations between the respective open to close returns are a violation of the efficient market hypothesis because public information about the performance in one market could be used to profitably trade in another market. If the markets are efficient, information about the open to close in one market (for example, the U.S. return in period t-1) will be fully reflected in the open price in the other market (Japan in period t). Since new information flows randomly into the market, subsequent price changes should be random and the open to close Japanese returns will be uncorrelated with the lagged U.S. returns. Thus, the performance in the U.S. should affect the open Nikkei price and the correlation between the open to close returns in the two markets should be zero.

However, high trading costs in Japan may prevent arbitrageurs from profiting from the high correlations. These trading costs, which are over 1%, wipe out excess profits.[5] However, traders with superior knowledge about future price changes would use cheaper, levered, futures contracts. Futures contracts on the Nikkei Index have been traded on the Singapore International Monetary Exchange (SIMEX) since late 1986.[6] The trading unit is 500 Japanese yen times the Nikkei Index.[7]

This paper examines the intertemporal relation between the U.S. market and the Nikkei futures. This paper has efficiency implications since high correlations imply that investors can profit simply by using the Nikkei futures to track the Japanese market, based on indications from the U.S. markets. As expected, the performance in the U.S. has a great impact on the overnight return in Singapore. However, the results in this paper are in contrast to the results with the S&P 500 and spot Nikkei Index. There is some evidence of overreaction in the futures markets, particularly after large increases in the S&P 500; this is a violation of the efficient market hypothesis, which implies that Bayes' rule determines the correct reply to new information. In contrast, overreaction suggests that people emphasize recent news and underweight prior information.

Overreaction has been documented by DeBondt and Thaler (1985) in the U.S. equity market and Stein (1989) in the options market. By forming equally weighted portfolios of stocks that had extreme high and low returns for the previous three years, DeBondt and Thaler find that the loser portfolio of stocks significantly outperformed the winner portfolio. The superior performance continues even up to 36 months after the original formulation. Their results suggest that equity prices follow a reverting or correcting pattern because investors overreact to both positive and negative information.

By examining the implied standard deviations of long and short-term options on the S&P 500, Stein found that the long-maturity options overreact to changes in the implied volatility of short-term options. However, this effect is small in economic magnitude.

In our case, the dramatic news is a large increase in the U.S. market. The market participants overreact by opening the futures contract price too high; therefore, subsequent daily returns will be smaller as the market tries to correct itself.

I. DATA AND METHODOLOGY

Daily opening and closing prices for the Nikkei Index futures are obtained from Chicago Mercantile Exchange Yearbooks for 1987 and 1988. Opening and closing values for the S&P 500 are also gathered for the same period. To ensure that extreme returns during the crash are not affecting the results, the crash period from October 19-30, 1987 is deleted from the sample.[8]

Futures prices are selected from the most active contract in a particular month, which occurs two to four months from expiration.[9] Daily arithmetic returns (using the opening and closing prices) are calculated for the S&P 500 and Nikkei futures. There are 507 U.S. returns and 498 Nikkei futures returns during this period. After the returns are merged, 481 observations exist for the U.S. daily returns leading the futures, and 467 observations for the U.S. impacting the Nikkei overnight returns.[10]

The trading unit of the futures contracts is 500 Japanese yen times the Nikkei average. To put the futures and S&P 500 returns on a common currency basis, the U.S. returns are converted to a yen equivalent. Opening and closing dollar/yen exchange rates are obtained from the Chicago Mercantile Exchange Yearbooks.

Correlations are calculated for the lagged S&P 500 returns, in both U.S. dollars and Japanese yen, and the Nikkei futures returns in the current period. To investigate how the U.S. performance affects the overnight futures return, the correlation is calculated between the lagged daily U.S. return and the current futures open to previous close return.

To analyze efficiency, a simulation is implemented in which a trader buys Nikkei futures at the open price when the local S&P 500 increases by .5%, 1%, 1.5%, or 2% the previous day and sells when the index decreases by the same percentages. The positions are closed at the end of the day. Profitable trading days are counted along with mean returns.

II. RESULTS

Table 1 presents the test of the U.S. leading the overnight returns and Table 2 illustrates the affect on the subsequent daily returns. The common and local currency results in Tables 1 and 2 are similar. As expected, the U.S. daily return has a great impact on the futures overnight return, with correlations between .60 and .63 for the lagged U.S. return and the Nikkei futures overnight return. The slope coefficient is approximately .40.

Insert Table 1 Here

The fact that the U.S. return greatly influences the futures overnight return is not surprising. Rather than examining all of the individual pieces of news since the last SIMEX close and guessing how the information will affect the open price, the traders look to the U.S. market for guidance. Goodhart (1988) states that this phenomenon is likely to occur if market participants believe that overseas markets are better able to access information than the trader could do by independently studying the effect of the news on share prices. Since the U.S. equity market is one of the largest in the world, investors are likely to trust the judgment of the market.

Consistent with market efficiency, the correlation between the lagged U.S. return and the current futures return is not statistically significant. However, an unexpected finding is that there is a negative relationship between the daily U.S. return and the futures performance. The correlations, although not statistically significant with a p-value of .13 for the local currency and .14 for the common currency returns, are approximately -.07.

Insert Table 2 Here

Results from the trading simulation, presented in Table 3, suggest that the futures market tends to overreact to large changes in the U.S. market. After the S&P 500 decreases substantially, the futures return the next day is substantial. For example, when the U.S. decreases by 1% or more, the mean open to close futures return is .191%, with a median return of .231%. In addition, 68% of the futures returns are up.

Insert Table 3 Here

In contrast, the futures performance is below average after substantial increases in the U.S. Median returns and the percentage up returns are below average, particularly for the 2% filter.

To determine if the mean of the futures returns after the filter is statistically different from the overall mean, the data are split up into two groups: the filter returns group and the rest of the returns. Then a t-test for the difference between two means is calculated.

The mean return after the 2% filter is statistically different from the rest of the returns at a 5% level of significance. The mean return of the filter is -.15% and the mean return for the other 454 returns is .07%.

The other mean filter returns are not statistically different from the rest of the returns. This result is not surprising, considering the lack of observations in the filter group. For example, there are 17 returns for the -2% trigger, for a mean futures return of .301%. The remainder of the returns (464) have a mean return of .045%. Although the mean for the filters are much higher, they are not statistically different because of lack of observations in the filter group.

The futures market seems to overreact to the news of large market movements in the U.S., particularly after increases. After a large market increase in the U.S., the opening price in Singapore tends to be too high. Subsequent changes are not independent of the U.S. performance as the market corrects for the overreaction.

III. CONCLUSION

This study investigates whether traders in the new Nikkei futures contracts can profit from high correlations between the U.S. equity market and the Japanese market. Thus, this study has efficient market implications because correlations between open to close returns of countries with no overlap in trading should be zero.

As expected, the lagged U.S. return has a great impact on the futures overnight return. Supporting market efficiency, the correlation between the lagged S&P 500 returns and the open to close futures returns is not statistically significant.

However, some evidence of overreaction exists as the open to close futures return tends to be inversely related to the U.S. return, particularly after a large increase in U.S. equities. This finding is consistent with the DeBondt and Thaler hypothesis that investors overreact to dramatic news events. After a large increase in the U.S. market, the open price in Singapore is too high and subsequent returns are negatively related to the U.S. return.

However, evidence of overreaction is not overwhelming. Most of the means of the filters are not statistically different from the remainder of the returns, even though the difference in mean returns is as high as .25%. The reason for the insignificance is a lack of returns in the filter groups. For example, only 17 returns exist for the -2% filter. More work needs to be done on this topic at a later time when more data are available.

NOTES

[1] The Nikkei Index is a broadly based, price-weighted average of 225 large, actively traded Japanese stocks traded on the Tokyo Stock Exchange. The index is calculated by Nihon Keizai Shimbur (Japan Economic Journal).

[2] Because Tokyo is 14 hours ahead of New York, there is no overlap between the two markets. Thus, the correlation between the lagged U.S. daily return and the current return in Japan is a test of the U.S. leading Japan. The correlation between the returns was much higher (.49) when the crash month of October 1987 was included in the sample. Without that month, the correlation was .26.

[3] For example, when the S&P 500 was up by 1% or more, the Nikkei Index increased 78% of the time the next day for a mean daily return of .507%. The 2% trigger predicted up returns for 76% of the trading days, for a mean return of .73%.

[4] After S&P 500 decreased by 1% or more, the Nikkei Index decreased 63% of the time the next trading day for a mean daily return of -.35%. The 2% down trigger was successful at selecting down trading days with 75% precision, for a mean return of -.699%.

[5] Trading costs are higher in Japan than in the U.S. For example, one-way transactions costs for a 1 billion yen trade (approximately $8 million) are .22%. In addition, the Japanese government imposes a transfer tax on the seller. The tax varies between .18% to .55% of the market value.

[6] Interest in these contracts has increased substantially. In early 1987, volume for the most active contract averaged around 1,000 contracts per day. In contrast, volume in late 1988 averaged approximately 3,000 contracts per day.

[7] The spot and futures markets open at 9:00 a.m. Tokyo time. The Tokyo Stock Exchange closes at 3:00 and the futures market closes at 3:15 Tokyo time.

[8] Volatility was extremely high during this period. Of the nine deleted daily returns, eight had an absolute value greater than 2%. The low return was -26.8% on October 20, and the high was 15.7% on October 27.

[9] Futures prices are obtained from the following contracts:

MONTHS	CONTRACT EXPIRATION
January, February 87	March 87
March, April, May 87	June 87
June, July, August 87	September 87
September, October, November 87	December 87
December 87, January, February 88	March 88
March, April, May 88	June 88
June, July, August 88	September 88
September, October, November 88	December 88
December 88	March 89

[10] When prices could not be obtained for a lagged or current trading day due to a closed market in one country, the observation is deleted from the sample. For example, assume that both markets are open Monday, Tuesday, and Thursday, with the Singapore market closed Wednesday. For a test of the U.S. leading the daily futures returns, observations are taken for Tuesday and Thursday. For the U.S. affecting the overnight Singapore return, only the Monday close to Tuesday open return is included. The Thursday close to open return is not included because the last close occurred Tuesday.

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Table 1

Regression and Correlation Results
Lagged U.S. Daily Returns
Leading Nikkei Futures Overnight Returns
T Value in Parentheses

$$\mathrm{NIKKEI}_{t}^{c-o} = \alpha_{US} + \beta_{US} \mathrm{S\&P}_{t-1}^{o-c} + \varepsilon_{US}$$

	Local Currency	Common Currency
INTERCEPT (ε_{US})	.0002	.0005*
	(0.98)	(1.73)
$\mathrm{S\&P}_{t-1}^{o-c}$ (ε_{US})	.3988***	.3263***
	(17.39)	(16.41)
F VALUE	302.37***	269.25***
R SQUARE	.3940	.3667
CORR	.6277***	.6056***

*** Significant at a 1% level
** Significant at a 5% level
* Significant at a 10% level

Table 2

Regression and Correlation Results
Lagged U.S. Daily Returns
Leading Nikkei Futures Open to Close Returns
T Value in Parentheses

$$NIKKEI_{t}^{o-c} = \alpha_{US} + \beta S\&P_{t-1}^{o-c} + \varepsilon_{US}$$

	Local Currency	Common Currency
INTERCEPT (ε_{US})	.0006	.0006
	(1.45)	(1.39)
$S\&P_{t-1}^{o-c}$ (ε_{US})	-.0356	-.0439
	(-1.51)	(-1.45)
F VALUE	2.29	2.10
R SQUARE	.0048	.0044
CORR	-.069	-.066

*** Significant at a 1% level
** Significant at a 5% level
* Significant at a 10% level

Table 3

Descriptive Statistics for Nikkei Futures Returns in Day t After Local Return S&P 500 Filter in Day t-1

FILTER	MEAN	MEDIAN	UP	DOWN	UNCH	%UP
-.5%	.143%	.173%	63	40	3	59%
-1%	.191%	.231%	43	19	1	68%
-1.5%	.095%	.302%	23	12	1	64%
-1%	.302%	.310%	12	4	1	71%
.5%	.025%	.000	75	70	6	50%
1%	.077%	.040%	45	35	3	54%
1.5%	.075%	.038%	25	21	1	53%
2%	-.155%**	-.129%	11	16	0	41%
ENTIRE DATA	.054%	.078%	268	198	15	56%

*** Significant at a 1% level
** Significant at a 5% level
* Significant at a 10% level

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